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Park et al.

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(54) **IMAGING CARTRIDGE AND ELECTROPHOTOGRAPHIC IMAGE FORMING APPARATUS USING THE SAME**

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See application file for complete search history.

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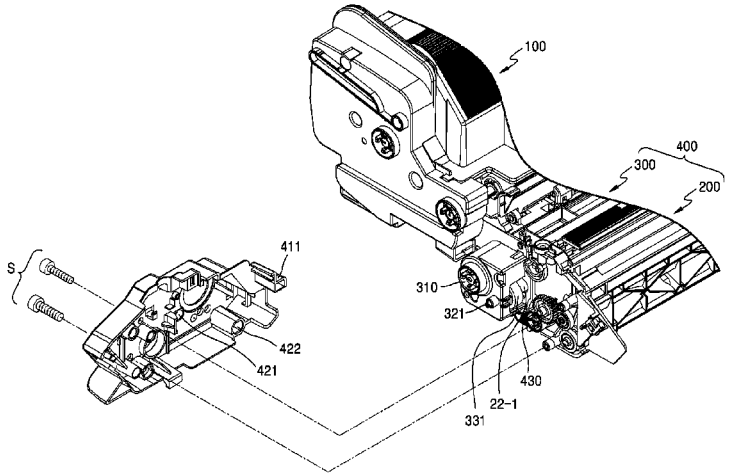
(57) **ABSTRACT**

An imaging cartridge includes a photoconductive unit including a photoconductor on which an elastic latent image is formed; a development unit including a development roller that supplies toner to the photoconductor to develop the toner and a gap maintaining member that constrains an approach distance of the development roller with respect to the photoconductor; a first position determining portion provided in the development unit; a lateral bracket that is fixed to a side portion of the photoconductive unit and has a second position determining portion that guides the first position determining portion so as to movably support the development unit; and an elastic member that applies to the development unit an elastic force in a direction in which the development roller approaches the photoconductive unit.

22 Claims, 10 Drawing Sheets



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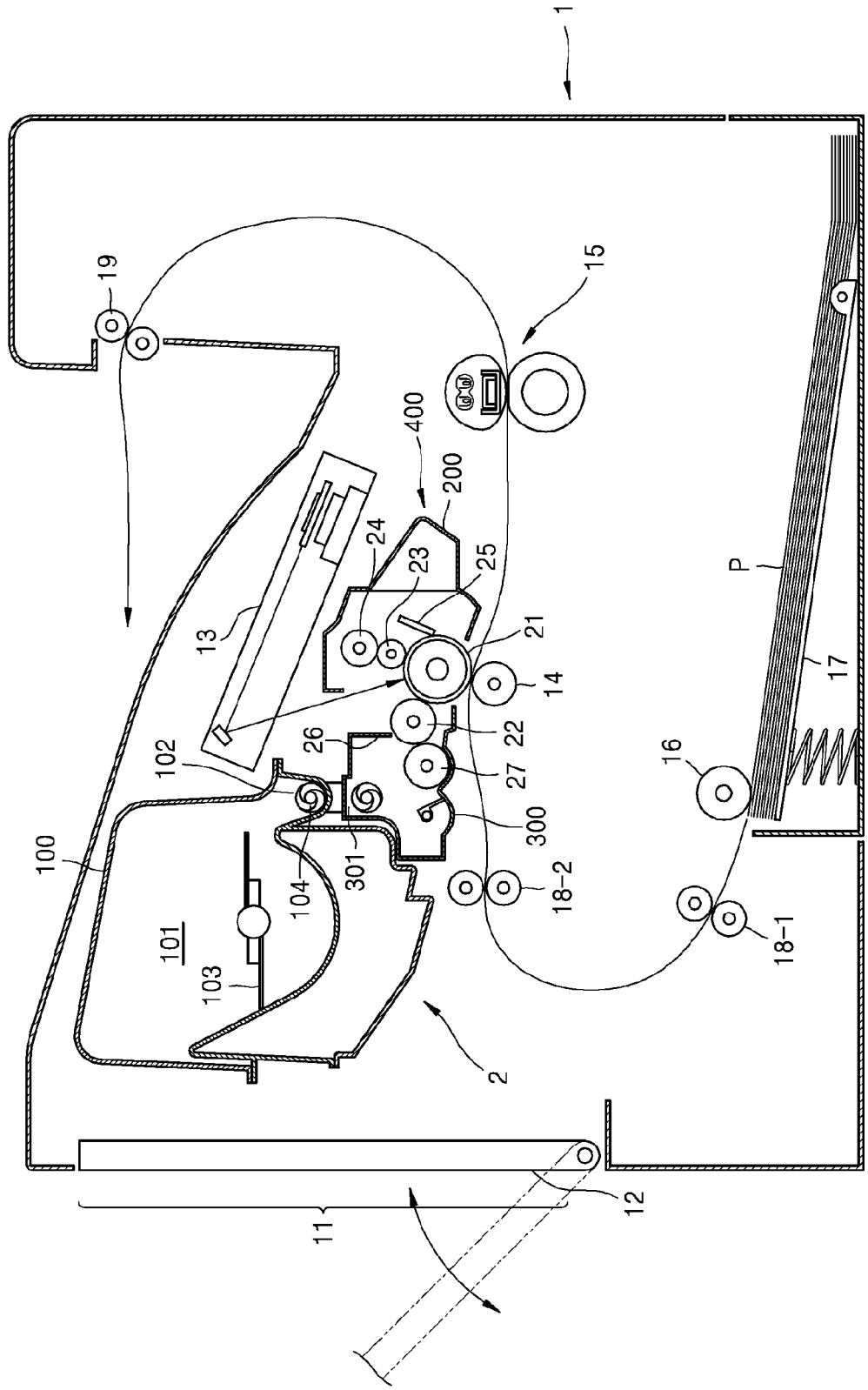

1
19
15
400
200
24
23
25
21
13
14
22
26
27
102
16
300
100
301
104
18-2
18-1
101
103
2
P
17
12
11

FIG. 1

FIG. 2

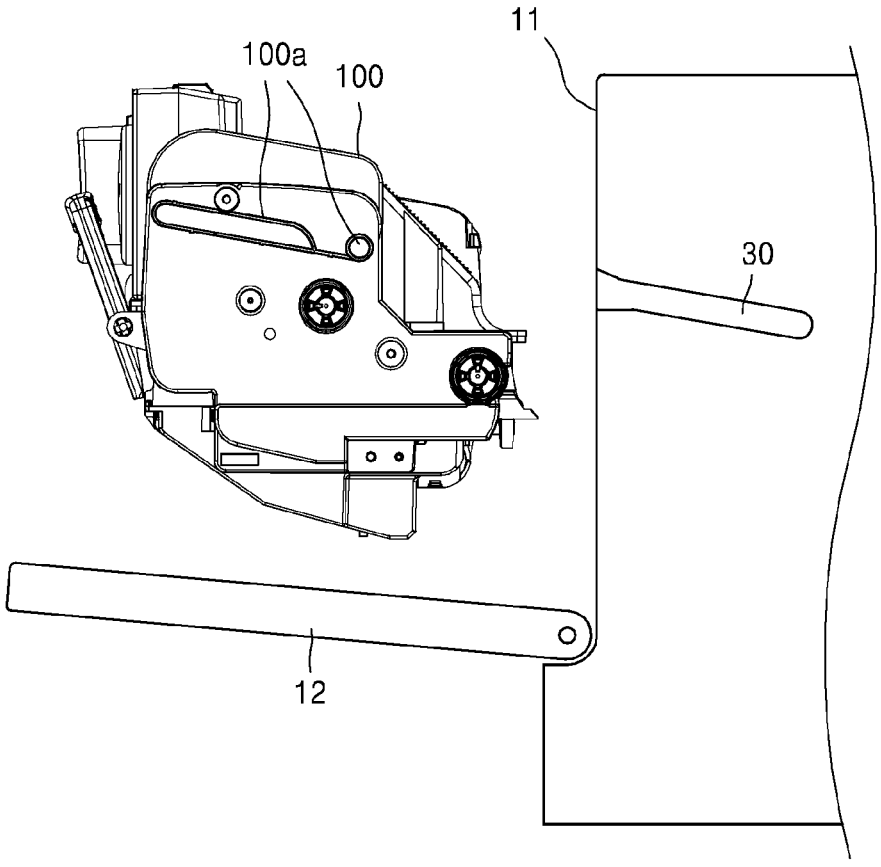


FIG. 3A

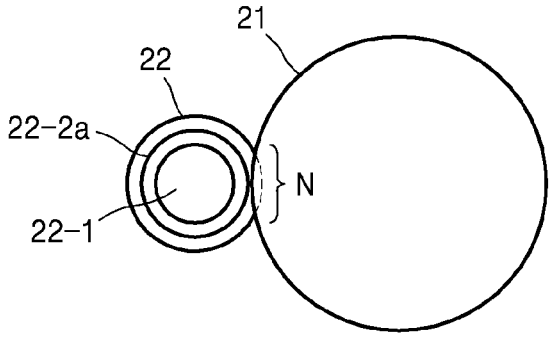
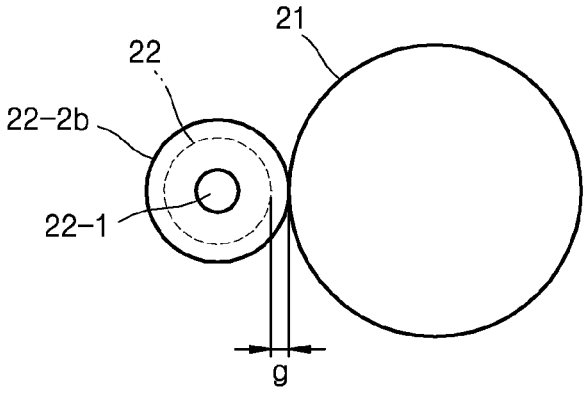


FIG. 3B



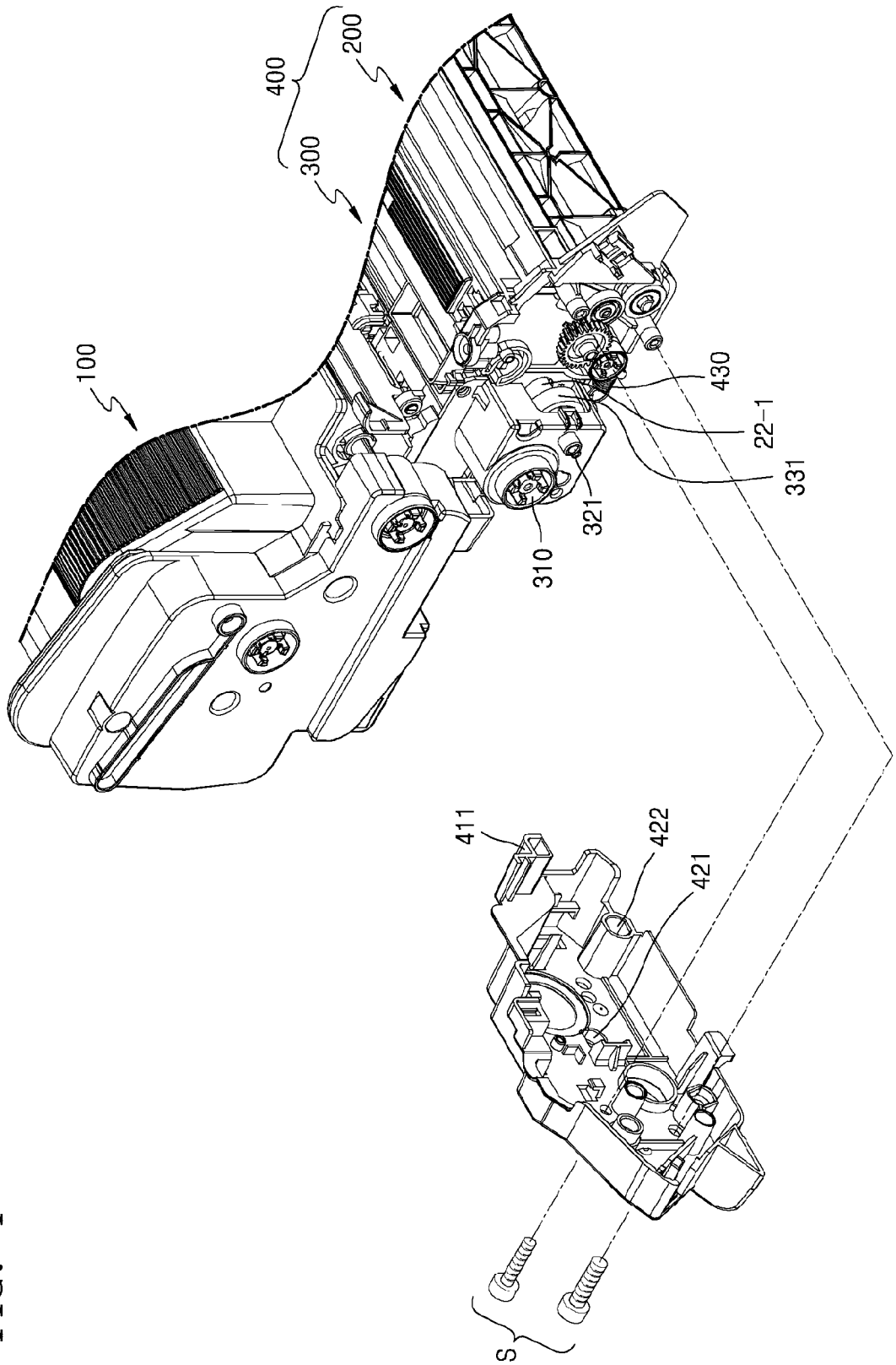


FIG. 4

FIG. 5

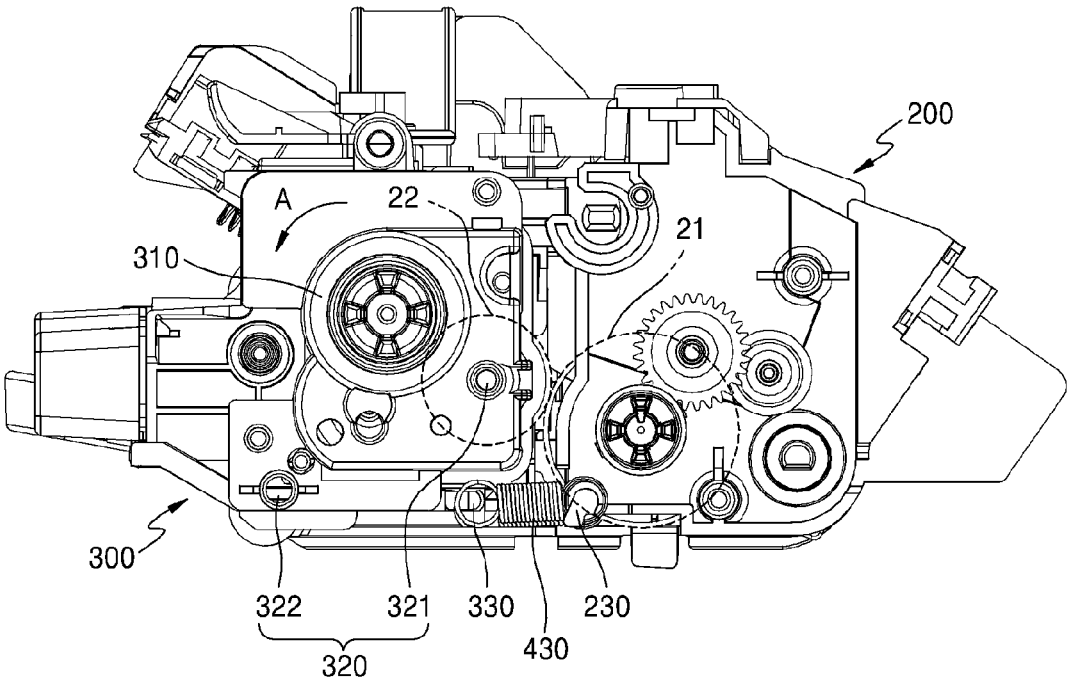

200
A
22
21
310
300
322
321
330
230
430
320

FIG. 6

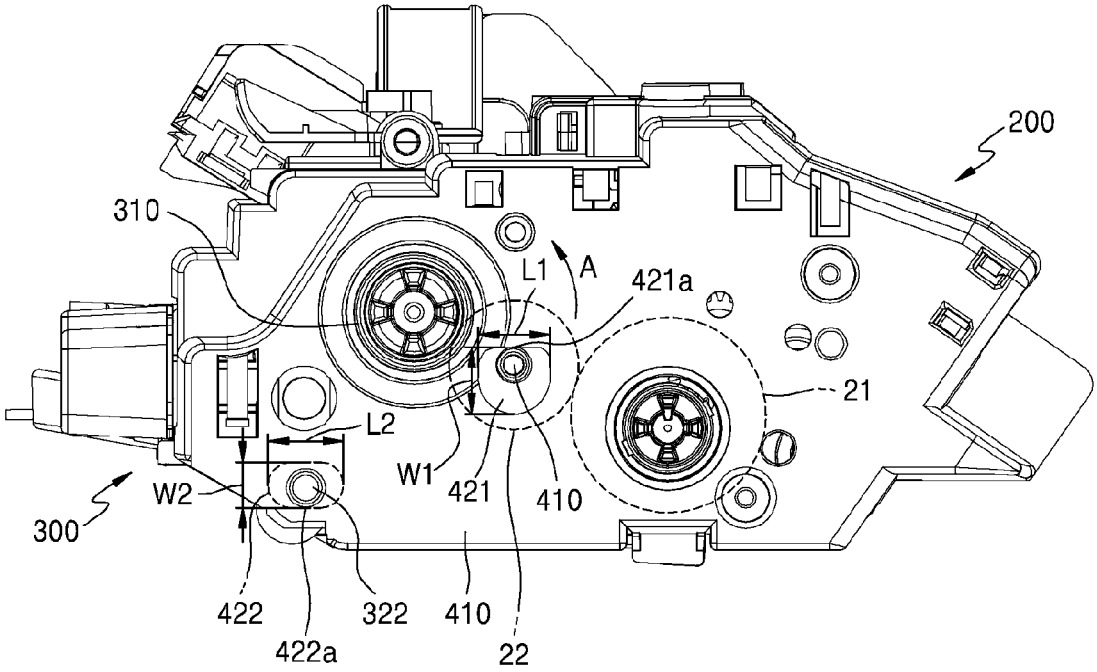

200
310
L1
A
421a
21
L2
W1
421
410
W2
300
422
322
410
422a
22

FIG. 7

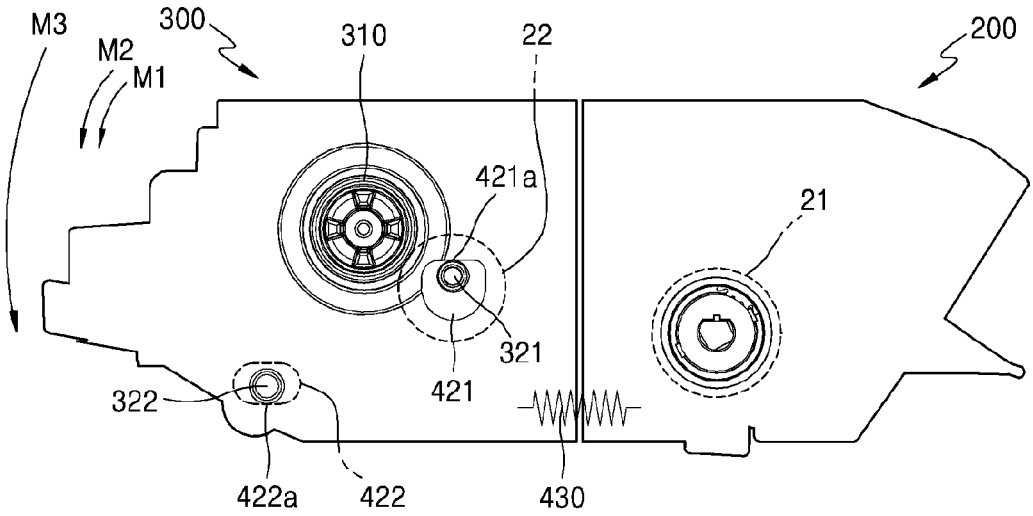

M3
M2
M1
300
310
22
200
421a
21
321
421
322
422a
422
430

FIG. 8

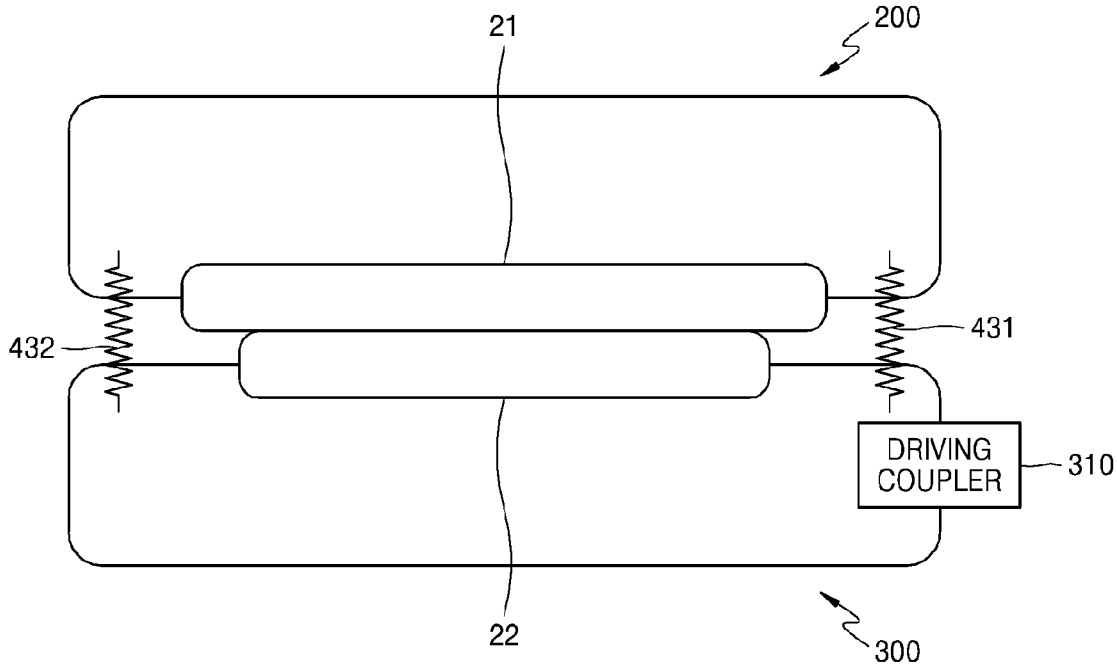

21
200
432
431
DRIVING COUPLER
310
22
300

FIG. 9

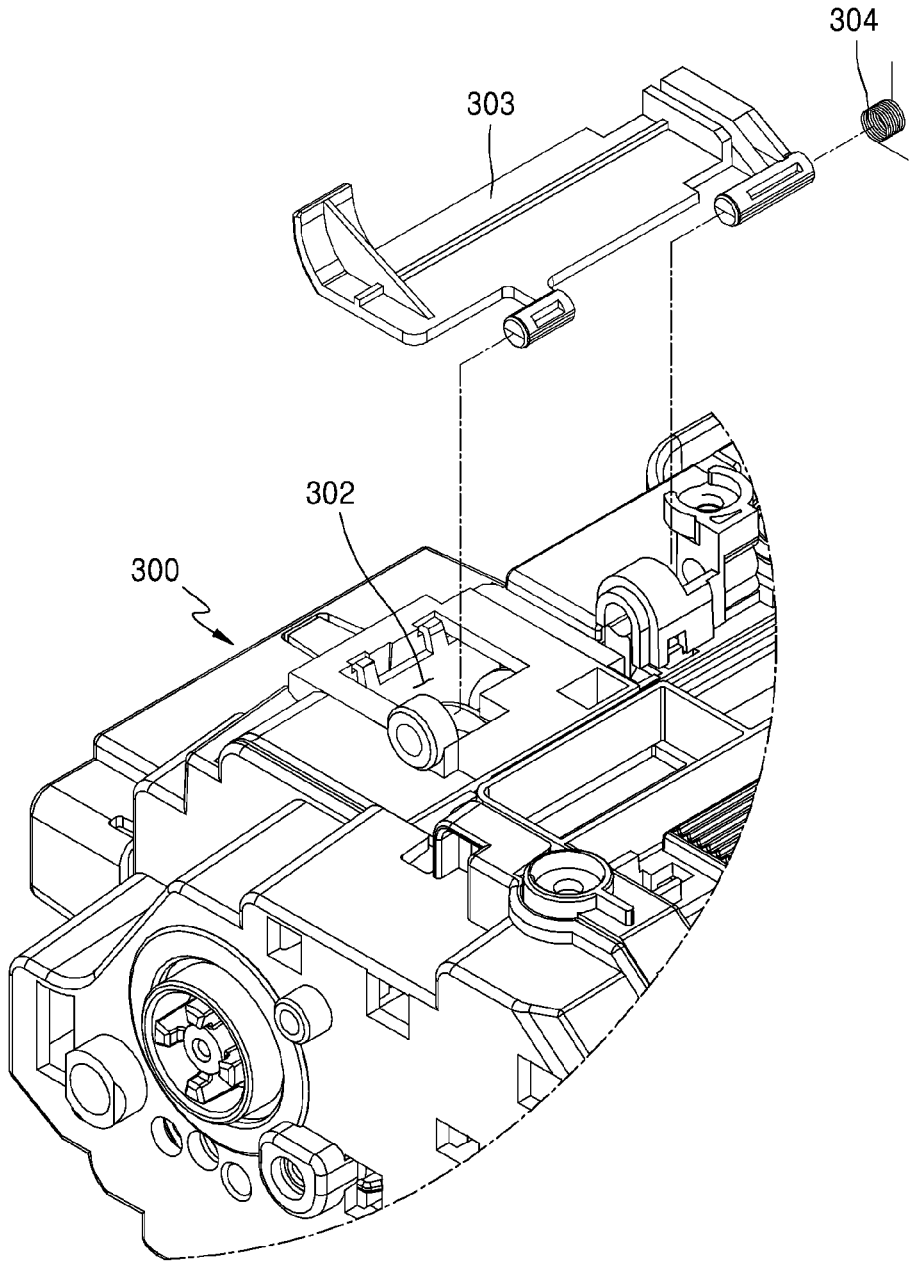
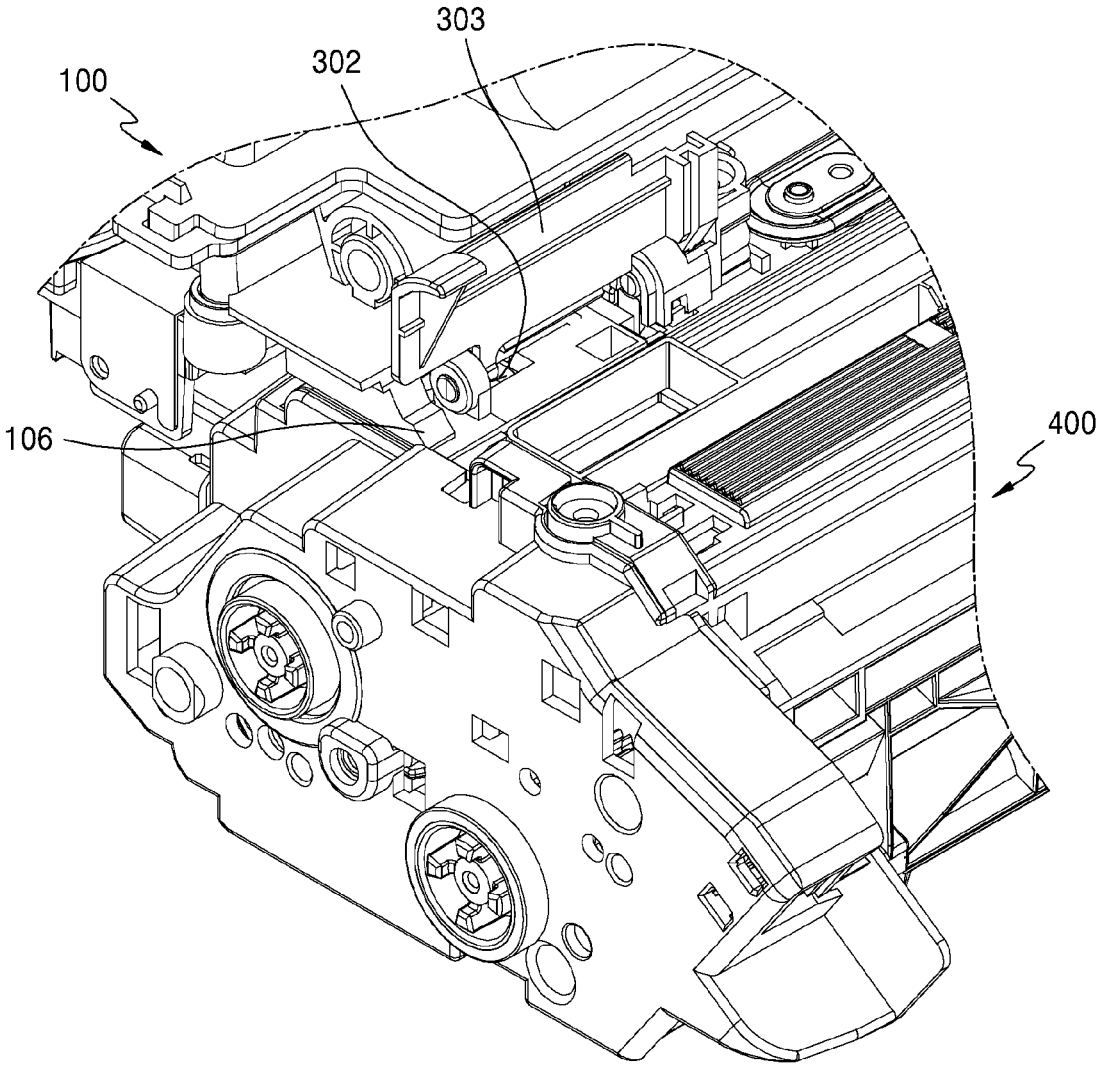


FIG. 10



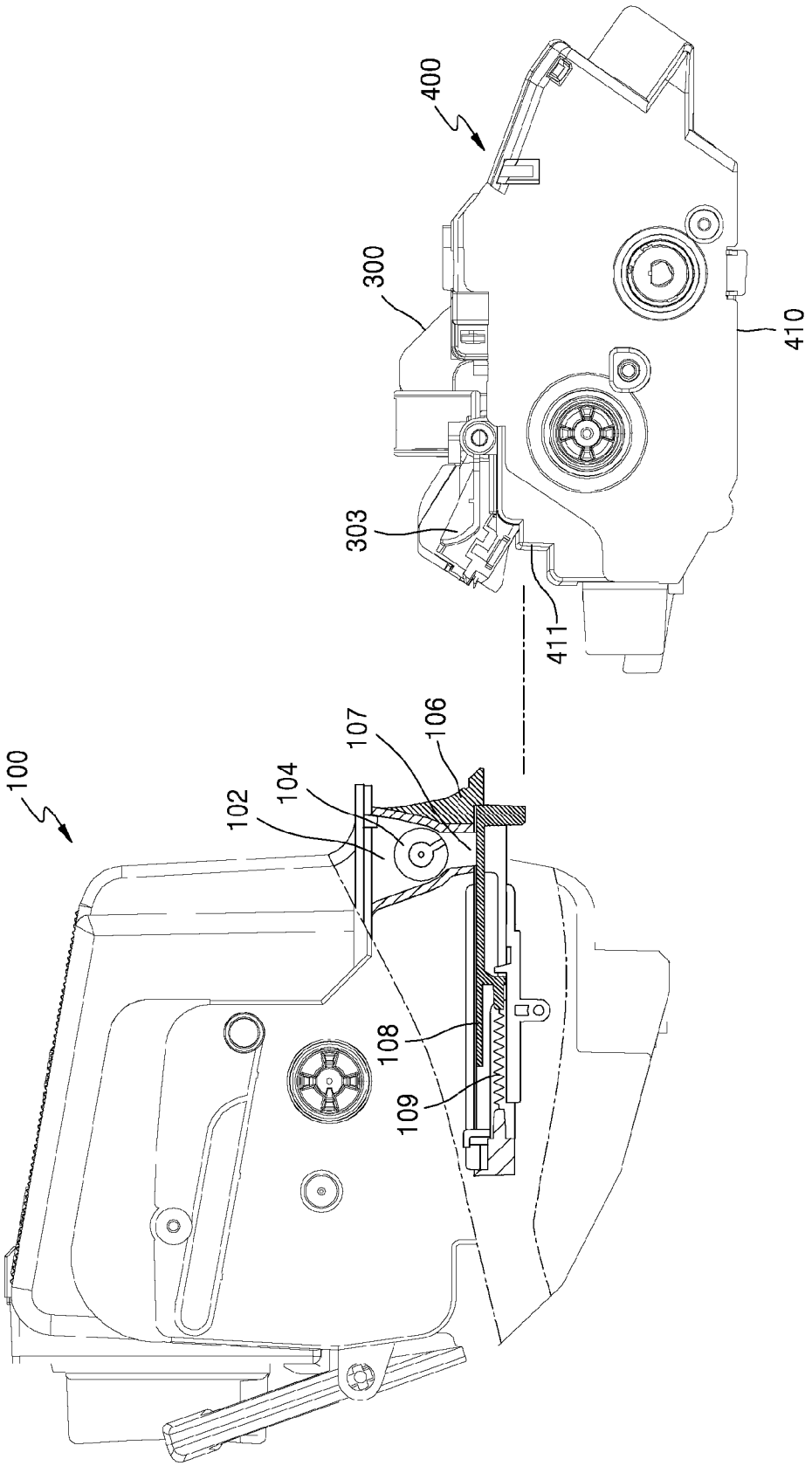


FIG. 11

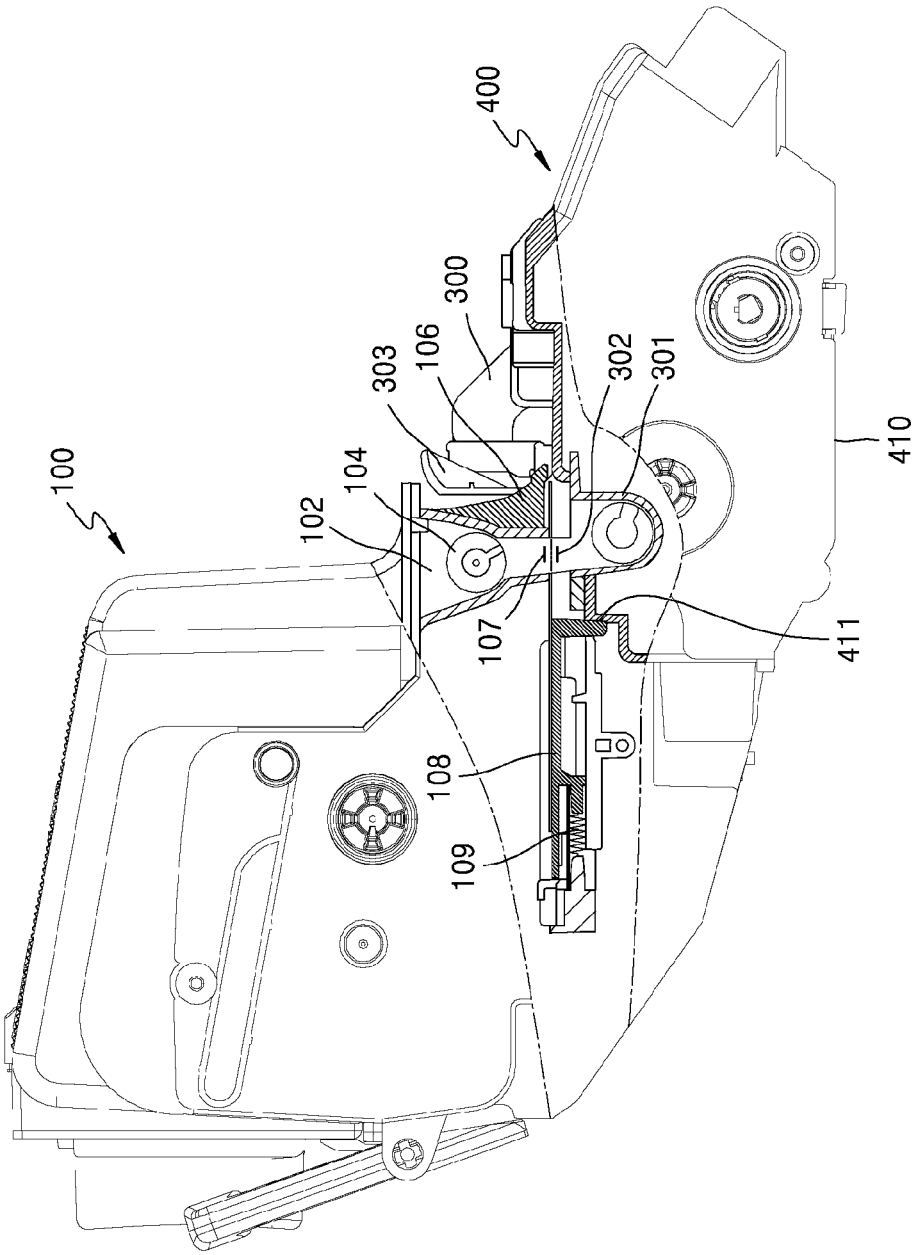


FIG. 12

IMAGING CARTRIDGE AND ELECTROPHOTOGRAPHIC IMAGE FORMING APPARATUS USING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the priority benefit of Korean Patent Application No. 10-2014-0054439, filed on May 7, 2014, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

BACKGROUND

1. Field

One or more embodiments relate to an image forming apparatus that forms an image on a recording medium and an imaging cartridge that is attached to or detached from the image forming apparatus.

2. Description of the Related Art

An electrophotographic image forming apparatus prints an image on a recording medium by supplying toner onto an electrostatic latent image formed on a photoreceptor to form a visible toner image on the photoreceptor, transferring the visible toner image onto the recording medium, and fusing the transferred visible toner image on the recording medium.

A process cartridge is an assembly of components for forming a visible toner image. The process cartridge is a consumable product that is detachable from a main body of an image forming apparatus and replaced after the lifespan thereof has ended. The process cartridge may have various structures such as a structure in which a photoreceptor, a development roller that supplies toner to the photoreceptor, and a container portion containing toner are integrally formed, a structure divided into an imaging cartridge including a photoreceptor and a development roller and a toner cartridge containing toner, or a structure divided into a photoreceptor cartridge including a photoreceptor, a development cartridge including a development roller, and a toner cartridge containing toner.

Regarding the process cartridge including the imaging cartridge and the toner cartridge, the imaging cartridge has a structure in which a photoconductive unit including a photoreceptor and a development unit including a development roller are connected to each other. In this case, in order to obtain a uniform image quality, a distance between the photoreceptor and the development roller has to be stably maintained.

SUMMARY

One or more embodiments include an imaging cartridge in which a distance between a photoreceptor and a development roller is stably maintained, and an image forming apparatus using the imaging cartridge.

Additional aspects will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the presented embodiments.

According to an aspect, an imaging cartridge that attached to or detached from a main body of an image forming apparatus, the imaging cartridge includes: a photoconductive unit including a photoconductor on which an elastic latent image is formed; a development unit including a development roller that supplies toner to the photoconductor to develop the toner and a gap maintaining member that constrains an approach distance of the development roller with respect to the photoconductor; a first position determining portion provided in the development unit; a lateral bracket that is fixed to a side portion of the photoconductive unit and includes a second position determining portion that guides the first position determining portion so as to movably support the development unit; and an elastic member that applies to the development unit an elastic force in a direction in which the development roller approaches the photoconductive unit.

The first position determining portion may include first and second position determining bosses, and the second position determining portion may include first and second position determining slots that have a length such that the development unit is moved in a direction in which the development roller approaches the photoconductor or is separated from the photoconductor. The first and second position determining slots may have a width such that the development unit is rotatable, and rotation of the development unit may be constrained as the first and second position determining bosses contact sidewalls of the first and second position determining slots in a width direction.

The imaging cartridge may further include a driving coupler that is provided at a side of the development unit and transfers a driving force of the main body to the development roller, wherein a rotational direction of the driving coupler is opposite a rotational direction of the development roller. A direction of a rotational moment applied to the development unit by the driving coupler may be the same as a direction of a rotational moment applied to the development unit by the elastic member.

The second position determining portion may include a rotation constraining unit that constrains rotation of the development unit.

The first position determining portion may include first and second position determining bosses, and the second position determining portion may include first and second position determining slots that have a length such that the development unit is moved in a direction in which the development roller approaches the photoconductor or is separated from the photoconductor, and the first position determining boss may be located at a rotational center of the development roller. The development roller may form a development nip by contacting the photoconductor.

The first position determining portion may include first and second position determining bosses, and the second position determining portion may include first and second position determining slots that have a length such that the development unit is moved in a direction in which the development roller approaches the photoconductor or is separated from the photoconductor, and the first and second position determining bosses may be disposed on the same side as the development roller with respect to an area where the development roller and the photoconductor face each other, and the driving coupler may be disposed between the first and second position determining bosses.

The imaging cartridge may further include a driving side portion where the driving coupler is disposed and a non-driving side portion on the opposite side the driving side portion, and the elastic member may include first and second elastic members that are respectively disposed on the driving side portion and the non-driving side portion, and an elastic force of the first elastic member may be smaller than an elastic force of the second elastic member.

According to an aspect, an imaging forming apparatus includes: a main body; and the imaging cartridge described

above, wherein the imaging cartridge is attached to or detached from the main body.

The imaging forming apparatus may further include a toner cartridge that is attached to or detached from the main body and supplies toner to the imaging cartridge. The toner cartridge may include a toner outlet through which the toner is discharged and a discharging shutter that opens or closes the toner outlet, wherein the discharging shutter is moved to a position where the toner outlet is opened by interfering with the imaging cartridge when the toner cartridge is mounted in the main body.

The lateral bracket may include an interference portion that interferes with the discharging shutter to move the discharging shutter to a position where the toner outlet is opened when the toner cartridge is mounted in the main body.

The toner cartridge may further include a shutter spring that elastically biases the discharging shutter such that the discharging shutter is moved to a position where the toner outlet is closed.

The imaging cartridge may include a toner inlet through which the toner enters and an inlet shutter that opens or closes the toner inlet. The imaging cartridge may further include a spring that elastically biases the inlet shutter to a position where the toner inlet is closed. The inlet shutter may be moved in connection with an operation of mounting of the toner cartridge to the main body to a position where the toner inlet is opened. A protrusion may be provided on the toner cartridge to open the inlet shutter.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings in which:

FIG. **1** is a schematic structural diagram of an electrophotographic image forming apparatus according to an embodiment;

FIG. **2** illustrates replacement of a toner cartridge;

FIG. **3**A is a diagram of an arrangement of a photoconductive drum and a development roller according to a contact development method;

FIG. **3**B is a diagram of an arrangement of a photoconductive drum and a development roller according to a non-contact development method;

FIG. **4** is a disassembled perspective view of an imaging cartridge from which a lateral bracket is separated, according to an embodiment;

FIG. **5** is a schematic side view of the imaging cartridge from which a lateral bracket is separated, according to an embodiment;

FIG. **6** is a side view of the imaging cartridge to which the lateral bracket is mounted;

FIG. **7** is a lateral view illustrating a photoconductive unit and a development unit that are connected in a variable axis manner;

FIG. **8** is a plan view illustrating a photoconductive unit and a development unit that are connected in a variable axis manner;

FIG. **9** is a schematic side perspective view of the imaging cartridge;

FIG. **10** is a side perspective view of the imaging cartridge when an inlet shutter is located at an open position via a toner cartridge;

FIG. **11** is a partial cross-sectional view illustrating a toner discharging unit of the toner cartridge; and

FIG. **12** is a partial cross-sectional view illustrating the toner cartridge mounted in a main body of the image forming apparatus.

DETAILED DESCRIPTION

Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. In this regard, the present embodiments may have different forms and should not be construed as being limited to the descriptions set forth herein. Accordingly, the embodiments are merely described below, by referring to the figures, to explain aspects of the present description.

FIG. **1** is a schematic structural diagram of an electrophotographic image forming apparatus according to an embodiment.

Referring to FIG. **1**, a main body **1** of the image forming apparatus and a process cartridge **2** are shown. The main body **1** includes an opening **11** providing a passage for the process cartridge **2** to be mounted in or removed from the main body **1**. A cover **12** closes or opens the opening **11**. The main body **1** includes an exposure unit **13**, a transfer roller **14**, and a fusing unit **15**. Also, the main body **1** includes a recording medium transfer structure for loading and transferring a recording medium P where an image is to be formed.

The process cartridge **2** may include a toner containing unit **101**, a photoconductive drum **21**, on a surface of which an electrostatic latent image is formed, and a development roller **22** that receives toner from the toner containing unit **101** to supply the toner to the electrostatic latent image so as to develop the electrostatic latent image into a visible toner image.

The process cartridge **2** may have a first structure divided into an imaging cartridge **400** including the photoconductive drum **21** and the development roller **22** and a toner cartridge **100** including the toner containing unit **101**, a second structure divided into a photoreceptor cartridge **200** including the photoconductive drum **21**, a development cartridge **300** including the development roller **22**, and a toner cartridge **100** including the toner containing unit **101**, a third structure divided into a photoreceptor cartridge **200** and a development cartridge **300** including the toner containing unit **101**, or a fourth structure in which a photoreceptor cartridge **200**, a development cartridge **300**, and a toner cartridge **100** are integrally formed with one another.

In the process cartridge **2** having the first structure (or the second structure), when the toner cartridge **100** is mounted in the main body **1**, the toner cartridge **100** is connected to the imaging cartridge **400** (or the development cartridge **300**). For example, when the toner cartridge **100** is mounted in the main body **1**, a toner discharging unit **102** of the toner cartridge **100** and a toner inlet portion **301** of the imaging cartridge **400** (or the development cartridge **300**) are connected to each other. A first toner supply member **103** that supplies toner to the toner discharging unit **102** is disposed in the toner containing unit **101**. A second toner supply member **104** that transports the toner in a length direction of the toner discharging unit **102** is disposed in the toner discharging unit **102**. The first toner supply member **103** radially transports the toner to supply the same to the toner discharging unit **102**. For example, a rotating paddle may be used as the first toner supply member **103**. The second toner supply member **104** transports the toner supplied by using the first toner supply member **104** in an axial direction of the

second toner supply member **104**. For example, an auger may be used as the second toner supply member **104**.

The process cartridge **2** according to an embodiment has the first structure. Thus, the imaging cartridge **400** and the toner cartridge **100** may be individually attached to or detached from the main body **1**. The process cartridge **2** is a consumable product that is replaced after its lifespan expires. The lifespan of the imaging cartridge **400** is longer than the lifespan of the toner cartridge **100**. When toner contained in the toner containing unit **101** is consumed completely, just the toner cartridge **100** may be replaced so as to reduce costs for replacement of consumables. Referring to FIG. **2**, for example, a guide protrusion **100***a* may be formed on a side portion of the toner cartridge **100**, and a guide rail **30** that guides the guide protrusion **100***a* may be provided in the main body **1**. The toner cartridge **100** may be guided by using the guide rail **30** to be attached to or detached from the main body **1**. Although not illustrated in the drawing, a guide unit that guides the imaging cartridge **400** is provided in the main body **1**.

The photoreceptor cartridge **200** includes the photoconductive drum **21**. The photoconductive drum **21** is an example of a photoreceptor, an electrostatic latent image being formed on a surface thereof, and may include a conductive metal pipe and a photosensitive layer around the conductive metal pipe. A charging roller **23** is an example of a charger for charging the photoconductive drum **21** to have a uniform surface potential. A charging brush or a corona charger may be used instead of the charging roller **23**. A cleaning roller **24** is used to remove foreign materials on a surface of the charging roller **23**. A cleaning blade **25** is an example of a cleaning unit for removing toner and foreign materials on a surface of the photoconductive drum **21** after a transfer process which will be described later. A cleaning unit having another shape, such as a rotating brush, may be used instead of the cleaning blade **25**. However, the cleaning blade **25** or the rotating brush are examples of a cleaning unit, but any type of cleaning unit can be used to clean photoconductive drum **21**.

The development cartridge **300** receives toner from the toner cartridge **100** to supply the toner to the electrostatic latent image so as to develop the electrostatic latent image into a visible toner image.

Examples of a development method include a one-component development method in which toner is used and a two-component development method in which toner and a carrier are used. The imaging cartridge **400** according to an embodiment uses a one-component development method.

The development roller **22** is used to supply toner to the photosensitive drum **21**. A development bias voltage to supply toner to the photosensitive drum **21** may be applied to the development roller **22**. The one-component development method may be classified into a contact development method, wherein the development roller **22** and the photoconductive drum **21** are rotated while contacting each other, and a non-contact development method, wherein the development roller **22** and the photoconductive drum **21** are rotated by being spaced apart from each other by dozens to hundreds of microns. FIG. **3**A is a diagram of an arrangement of the photoconductive drum **21** and the development roller **22** in the contact development method, and FIG. **3**B is a diagram of an arrangement of the photoconductive drum **21** and the development roller **22** in the non-contact development method. Referring to FIG. **3**A, in the contact development method, a gap maintaining member **22-2***a* having a smaller diameter than the development roller **22** may be provided on each of both ends of a rotation shaft **22-1** of the development roller **22**. The photoconductive drum **21** is constrained by the gap maintaining member **22-2***a* which contacts the surface of the photoconductive drum **21**. A development nip N is formed as the development roller **22** contacts the photoconductive drum **21**. Referring to FIG. **3**B, in the non-contact development method, a gap maintaining member **22-2***b* having a larger diameter than the development roller **22** may be provided on each of the both ends of the rotation shaft **22-1** of the development roller **22**. A development gap g between the development roller **22** and the photoconductive drum **21** is formed in a development region where the development roller **22** and the photoconductive drum **21** face each other as the gap maintaining member **22-2***b* contacts the surface of the photoconductive drum **21**.

The gap maintaining members **22-2***a* and **22-2***b* maintains a constant distance between the development roller **22** and the photoconductive drum **21** so that the development nip N or the development gap g is maintained constant too. The gap maintaining members **22-2***a* and **22-2***b* do not necessarily contact a surface of the photoconductive drum **21**. Also, the gap maintaining members **22-2***a* and **22-2***b* do not have to be necessarily mounted on the rotation shaft **22-1** of the development roller **22**.

A regulator **26** constrains an amount of toner supplied by the development roller **22** to a development region where the photoconductive drum **21** and the development roller **22** face each other. The regulator **26** may be a doctor blade elastically contacting a surface of the development roller **22**. A supply roller **27** supplies toner in the process cartridge **2** to a surface of the development roller **22**. To this end, a supply bias voltage may be applied to the supply roller **27**.

When a two-component development method is used, the development roller **22** is spaced apart from the photoconductive drum **21** by dozens to hundreds of microns. Although not illustrated in the drawings, the development roller **22** may have a structure in which a magnetic roller is disposed in a hollow cylindrical sleeve. The toner is adhered to a surface of a magnetic carrier. The magnetic carrier is adhered to the surface of the development roller **22** to be transferred to the development region where the photoconductive drum **21** and the development roller **22** face each other. Only the toner is supplied to the photoconductive drum **21** according to the development bias voltage applied between the development roller **22** and the photoconductive drum **21**, and thus the electrostatic latent image formed on the surface of the photoconductive drum **21** is developed into the visible toner image. The process cartridge **2** may include an agitator (not shown) for mixing and stirring the toner and a carrier and transporting the mixture to the development roller **22**. The agitator may be, for example, an auger or a plurality of the agitators.

The exposure unit **13** forms the electrostatic latent image on the photoconductive drum **21** by irradiating light modulated according to image information to the photoconductive drum **21**. The exposure unit **13** may be a laser scanning unit (LSU) using a laser diode as a light source, or a light-emitting diode (LED) exposure unit using an LED as a light source.

The transfer roller **14** is an example of a transfer unit for transferring a toner image from the photoconductive drum **21** to the recording medium P. A transfer bias voltage for transferring the toner image to the recording medium P is applied to the transfer roller **14**. A corona transfer unit or a transfer unit using a pin scorotron method may be used instead of the transfer roller **14**.

The recording media P are picked up one by one from a loading table **17** by a pickup roller **16**, and are transferred by feed rollers **18-1** and **18-2** to a region where the photoconductive drum **21** and the transfer roller **14** face each other.

The fusing unit **15** applies heat and pressure to an image transferred to the recording medium P so as to fuse the image on the recording medium P. The recording medium P that passed through the fusing unit **15** is discharged outside the main body **1** by a discharge roller **19**.

According to the above structure, the exposure unit **13** irradiates the light modulated according to the image information to the photoconductive drum **21** to develop the electrostatic latent image. The development roller **22** supplies the toner to the electrostatic latent image to form the visible toner image on the surface of the photoconductive drum **21**. The recording medium P loaded in the loading table **17** is transferred to the region where the photoconductive drum **21** and the transfer roller **14** face each other by the pickup roller **16** and the feed rollers **18-1** and **18-2**, and the toner image is transferred on the recording medium P from the photoconductive drum **21** according to the transfer bias voltage applied to the transfer roller **14**. After the recording medium P passes through the fusing unit **15**, the toner image is fused on the recording medium P according to heat and pressure. After the fusing, the recording medium P is discharged by the discharge roller **19**.

Hereinafter, the photoreceptor cartridge **200** and the development cartridge **300** which constitute the imaging cartridge **400** will be referred to as a photoconductive unit **200** and a development unit **300**, respectively. The photoconductive unit **200** and the development unit **300** are connected to each other such that the development nip N or the development gap g may be maintained constant. To this end, the photoconductive unit **200** and the development unit **300** may be fixedly connected by using a pair of lateral brackets (not shown). According to a connection method described above (a fixed axis method), a distance between the photoconductive drum **21** and the development roller **22** is fixed. While the fixed axis method has a simple structure, an accuracy regarding the development nip N or the development gap g is determined based on tolerances of components of the photoconductive unit **200** or the development unit **300**, and thus, components having a high dimensional precision are required. Moreover, if the components are worn away after use for long time, the distance between the photoconductive drum **21** and the development roller **22** changes, and accordingly, the development nip N or the development gap g are also changed. This may decrease the uniformity of an image quality.

Regarding the imaging cartridge **400** according to an embodiment, the photoconductive unit **200** and the development unit **300** are connected with each other by using a variable axis method in which the development unit **300** is movable with respect to the photoconductive unit **200**. According to this structure, when components are worn away due to long time use, even if a distance between the photoconductive drum **21** and the development roller **22** varies, the development unit **300** is movable with respect to the photoconductive unit **200** to maintain the development nip N or the development g, and thus, the uniformity of an image quality may be improved.

Hereinafter, a connection unit that connects the photoconductive unit **200** and the development unit **300** when a variable axis method is used will be described according to an embodiment. FIG. **4** is a disassembled perspective view of the imaging cartridge **400** from which a lateral bracket **410** is separated. FIG. **5** is a schematic side view of the imaging cartridge **400** from which the lateral bracket **410** is separated. FIG. **6** is a side view of the imaging cartridge **400** to which the lateral bracket **410** is mounted.

Referring to FIGS. **4**, **5**, and **6**, the lateral bracket **410** is coupled to a side portion of the photoconductive unit **200**, that is, a side portion in a length direction of the photoconductive drum **21**. The lateral bracket **410** may be coupled to the side portion of the photoconductive unit **200** by using, for example, a screw S.

A driving coupler **310** is provided in the development unit **300**. The driving coupler **310** is connected to a driving unit (not shown) provided in a main body **1** when the imaging cartridge **400** is mounted in the main body **1**. As the driving coupler **310** is connected to the development roller **22**, a driving force supplied from the main body **1** is transferred to the development roller **22**. For example, the driving coupler **310** includes a gear portion (not shown) that is engaged with a gear **331** mounted on the rotation shaft **22-1** of the development roller **22**. A rotational direction of the driving coupler **310** is opposite to a rotational direction of the development roller **22**.

A position determining unit that determines a position of the development roller **22** with respect to the photoconductive drum **21** is provided in the imaging cartridge **400**. A plurality of first position determining portions **321** and **322** are provided in the development unit **300**. Second position determining portions **421** and **422** corresponding to the first position determining portions **321** and **322** are provided in the lateral bracket **410**. The second position determining portions **421** and **422** may respectively have a complementary shape with respect to the first position determining portions **321** and **322**. The second position determining portions **421** and **422** guide the first position determining portions **321** and **322** such that the development unit **300** may be moved in a direction in which the development roller **22** approaches the photoconductive drum **21** or is separated from the photoconductive drum **21**. For example, the first position determining portions **321** and **322** may have a boss shape protruding from the side portion of the development unit **300**. Hereinafter, the first position determining portions **321** and **322** will be referred to as first and second position determining bosses **321** and **322**. The first and second position determining bosses **321** and **322** may be, for example, cylindrical. The second position determining portions **421** and **422** may have a slot shape that guides the first and second position determining bosses **321** and **322**. Hereinafter, the second position determining portions **421** and **422** will be referred to as first and second position determining slots **421** and **422**.

An elastic member **430** applies to the development unit **300** an elastic force in a direction in which the development roller **22** approaches the photoconductive drum **21**. The elastic member **430** may be, for example, a tensile coil spring. Spring hook portions **330** and **230** respectively supporting first and second ends of the elastic member **430** may be respectively provided in the development unit **300** and the photoconductive unit **200**. The shape of the elastic member **430** is not limited to the tensile coil spring. The elastic member **430** may have various forms as long as an elastic force exerted in a direction in which the development roller **22** approaches the photoconductive drum **21** is applied to the development unit **300**. For example, the elastic member **430** may be a leaf spring, or according to an arrangement position thereof, a compressed coil spring.

The lateral bracket **410** including the first and second position determining slots **421** and **422**, the first and second position determining bosses **321** and **322**, and the elastic

member **430** are provided on two sides of the imaging cartridge **400** in a length direction of the photoconductive drum **21**.

When the imaging cartridge **400** is mounted in the main body **1** and the driving coupler **310** is connected to a driving unit (not shown) provided in the main body **1**, the driving coupler **310** is rotated in an arrow direction A of FIG. **5**. Due to rotation of the driving coupler **310**, a moment in the arrow direction A is exerted on the development unit **300**. The first and second position determining slots **421** and **422** respectively have lengths L**1** and L**2** and widths W**1** and W**2**. The lengths L**1** and L**2** and the widths W**1** and W**2** of the first and second position determining slots **421** and **422** are determined such that the development unit **300** may be moved in a direction in which the development roller **22** approaches the photoconductive drum **21** or is separated from the photoconductive drum **21**. The widths W**1** and W**2** of the first and second position determining slots **421** and **422** are greater than diameters of the first and second position determining bosses **321** and **322**. Rotation of the development unit **300** in the arrow direction A is constrained as the first and second position determining bosses **321** and **322** respectively contact side walls **421***a* and **422***a*. Accordingly, a rotation constraining unit that constrains rotation of the development unit **300** in the arrow direction A may be formed of the side walls **421***a* and **422***a* of the first and second position determining slots **421** and **422**. Hereinafter, the side walls **421***a* and **422***a* will be referred to as rotation constraining units **421***a* and **422***a*.

Relative positions of the first and second position determining slots **421** and **422** of the lateral bracket **410** disposed at one side portion of the imaging cartridge **400** may be the same as positions of position determining slots (not shown) of another lateral bracket (not shown) disposed at the other side portion thereof. However, an error may occur in the relative positions of the first and second position determining slots **421** and **422** during the manufacture of the lateral bracket **410**. When the widths W**1** and W**2** of the first and second position determining slots **421** and **422** are the same as the diameters of the first and second position determining bosses **321** and **322**, and if there is an error in the relative positions, the development roller **22** and the photoconductive drum **21** may not be parallel and an image defect such as an image omission may be generated. As the widths W**1** and W**2** of the first and second position determining slots **421** and **422** are greater than the diameters of the first and second position determining bosses **321** and **322**, a margin where the error in the relative positions of the first and position determining slots **421** and **422** of the lateral bracket **410** disposed at one side portion of the imaging cartridge **400** and the positions of position determining slots (not shown) of the lateral bracket (not shown) at the other side portion thereof may be secured, and an image defect such as an image omission due to distortion of the development roller **22** and the photoconductive drum **21** may be prevented.

FIGS. **7** and **8** are schematic views illustrating the photoconductive unit **200** and the development unit **300** that are connected in a variable axis manner. FIG. **7** is a side view and FIG. **8** is a plan view.

Referring to FIG. **7**, due to an elastic force of the elastic member **430**, the development unit **300** approaches the photoconductive drum **21**, and the approaching movement of the development unit **300** toward the photoconductive drum **21** is allowed as the first and second position determining bosses **321** and **322** are guided to the first and second position determining slots **421** and **422**. The approaching movement of the development unit **300** toward the photoconductive drum **21** is constrained by the gap maintaining members **22-2***a* and **22-2***b* described above with reference to FIGS. **3**A and **3**B. According to this structure, the development nip N or the development gap g may be stably maintained.

A rotational moment M**3** is exerted on the development unit **300** in a direction in which the development nip N or the development gap g is maintained constant. The rotational moment M**3** may include a rotational moment M**1** due to the driving coupler **310** and a rotational moment M**2** due to the elastic member **430**. When the rotational moment M**2** due to the elastic member **430** and the rotational moment M**1** due to the driving coupler **310** are in opposite directions, the rotational moment M**2** is offset by the rotational moment M**1**, thereby reducing the rotational moment M**3** which maintains the development nip N or the development gap g constant. In other words, the elastic force of the elastic member **430** that maintains constant the development nip N or the development gap g is reduced by the rotational moment M**1**. By setting the rotational moment M**1** and the rotational moment M**2** to operate in the same direction, a sum of the rotational moment M**3** that maintains constant the development nip N or the development gap g may be increased, and a decrease in the elastic force of the elastic member **430** due to the rotational moment M**1** may be prevented. Accordingly, the development nip N or the development gap g may be more stably and easily maintained constant. An excessive rotation of the development unit **300** by the rotational moment M**3** is constrained by the rotation constraining units **421***a* and **422***a* (sidewalls **421***a* and **422***a*) provided on the first and second position determining slots **421** and **422**.

When one of the first and second position determining bosses **321** and **322** is disposed on the opposite side of the development roller **22** with respect to the development nip N or the development gap g, that is, at the photoconductive drum **21**, the rotational moment M**2** due to the elastic force of the elastic member **430** is exerted such that the development roller **22** is separated from the photoconductive drum **21**, and accordingly, the development nip N or the development gap g may be unstable. According to an embodiment, the first and second position determining bosses **321** and **322** are disposed on the same side as the development roller **22** with respect to the development nip N or the development gap g. Accordingly, the development nip N or the development g may be stably maintained constant.

The driving coupler **310** is disposed on the same side as the development roller **22** with respect to the development nip N or the development gap g. The driving coupler **310** is disposed between the first and second position determining bosses **321** and **322**. A rotational direction of the driving coupler **310** is opposite a rotational direction of the development roller **22**.

According to an embodiment, a contact development method, in which the development roller **22** and the photoconductive drum **21** rotate while contacting each other, is used. In the contact type development method, a repulsive force that is proportional to a size of the development nip N is applied to the development roller **22**, and a direction of rotational moment applied to the development unit **300** due to the repulsive force is a direction in which the development roller **22** and the photoconductive drum **21** are separated from each other. In order to keep the rotational moment due to the repulsive force as small as possible, one of the first and second position determining bosses **321** and **322** may be coaxially disposed with respect to the rotation shaft **22-1** of

the development roller **22** (see FIGS. **3**A and **3**B). That is, the first position determining boss **321** is disposed at a rotational center of the development roller **22**. According to this structure, the elastic force of the elastic member **430** may be used as much as possible in maintaining the development nip N constant, and thus, the development nip N may be stably maintained constant. Also, by disposing the first position determining boss **321** at the rotational center of the development roller **22**, the number of positions for position management for maintaining the development nip N may be reduced.

Referring to FIG. **8**, the elastic member **430** may include first and second elastic members **431** and **432** respectively disposed on sides of the development unit **300** and the photoconductive unit **200** and apply to the development unit **300** an elastic force in a direction in which the development roller **22** approaches the photoconductive drum **21**.

The driving coupler **310** is disposed at a side portion of the development unit **300**. The side portion of the imaging cartridge **400** where the driving coupler **310** is disposed is referred to as a driving side portion, and an opposite side portion of the imaging cartridge **400** is referred to as a non-driving side portion. The first and second elastic members **431** and **432** are respectively disposed at the driving side portion and the non-driving side portion.

As the elastic forces of the first and second elastic members **431** and **432** are equal, almost the same nip pressure is applied to the entire development nip N when the imaging cartridge **400** is not driven. The nip pressure is formed by the elastic forces of the first and second elastic members **431** and **432**. When the imaging cartridge **400** is driven, a rotational moment due to the driving coupler **310** is exerted, and thus, the nip pressure of the development nip N is greater in an area where the driving coupler **310** is disposed than in an area where the driving coupler **310** is not. A deviation in the nip pressure in a length direction of the development nip N may cause a deviation in image quality in a length direction. Also, non-uniformity in the nip pressure in the length direction may cause a deviation in an amount of abrasion of the development roller **22** and the photoconductive drum **21** in the length direction. That is, the development roller **22** and the photoconductive drum **21** are worn away more at the side with a relatively high nip pressure, which results in a decrease in the lifetime of the imaging cartridge **400**.

According to an embodiment, the elastic force of the first elastic member **431** disposed at the side where the driving coupler **310** is installed is smaller than the elastic force of the second elastic member **432** disposed at the opposite side. Accordingly, the nip pressure may be uniform over the entire development nip N. A difference in the elastic forces of the first elastic member **431** and the second elastic member **432** may be determined in consideration of a size of the rotational moment applied to the development unit **300** by using the driving coupler **310**.

FIG. **9** is a schematic side perspective view of the imaging cartridge **400**. Referring to FIG. **9**, in order to prevent leakage of toner during handling of the imaging cartridge **400** or when attaching or detaching the imaging cartridge **400** to or from the main body **1**, the toner inlet portion **301** (see FIG. **1**) of the development unit **300** includes an inlet shutter that opens or closes the toner inlet **302**. The inlet shutter **303** may be pivoted to a position where the toner inlet **302** is closed or to a position where the toner inlet **302** is opened. The inlet shutter **303** may be elastically biased via a spring **304** so as to be pivoted in a direction in which the toner inlet **302** is closed. The inlet shutter **303** may be moved to an opening position in connection with an operation of mounting the toner cartridge **100** to the main body **1**.

FIG. **10** is a side view illustrating the imaging cartridge **400** when the inlet shutter **303** is located at the opening position via the toner cartridge **100**. Referring to FIG. **10**, a protrusion **106** via which the inlet shutter **303** is pivoted may be provided in the toner cartridge **100**. When the toner cartridge **100** is started to be mounted in the main body **1**, the protrusion **106** contacts the inlet shutter **303**, and as the toner cartridge **100** is inserted into the main body **1**, the inlet shutter **303** is pushed by the protrusion **106** to be pivoted. When mounting of the toner cartridge **100** is completed, the inlet shutter **303** is located at the position where the toner inlet **302** is opened, as illustrated in FIG. **10**. When the toner cartridge **100** is detached from the main body **1**, the inlet shutter **303** is returned to the position where the toner inlet **302** is closed by the elastic force of the spring **304**.

FIG. **11** is a partial cross-sectional view illustrating the toner discharging unit **102** of the toner cartridge **100**. FIG. **12** is a partial cross-sectional view illustrating the toner cartridge **100** mounted in the main body **100**.

Referring to FIG. **11**, a toner outlet **107** via which toner is supplied to the development unit **300** is provided in the toner discharging unit **102** of the toner cartridge **100**. In order to prevent leakage of toner through the toner outlet **107** when handling the toner cartridge **100**, a discharging shutter **108** that opens or closes the toner outlet **107** is provided in the toner cartridge **100**. When the toner cartridge **100** is detached from the main body **1**, the discharging shutter **108** is located at a position where the toner outlet **107** is blocked, as illustrated in FIG. **11**. The shutter spring **109** applies to the discharging shutter **108** an elastic force in a direction in which the discharging shutter **108** closes the toner outlet **107**.

In a state where the toner cartridge **100** is mounted in the main body **1**, the discharging shutter **108** is located at a position where the toner outlet **108** is opened, as illustrated in FIG. **12**. When the toner cartridge **100** is mounted in the main body **1**, the discharging shutter **108** is moved to a position where the toner outlet **107** is opened due to interference with the lateral bracket **410**, as illustrated in FIG. **12**. Accordingly, the toner outlet **107** is aligned with the toner inlet **302** so that toner may be supplied from the toner cartridge **100** to the development unit **300**.

The lateral bracket **410** has an interference portion **411** that interferes with the discharging shutter **108** when the toner cartridge **100** is mounted in the main body **1**. When the discharging shutter **108** directly interferes with the development unit **300** in order to open or close the toner outlet **107**, the development nip N or the development gap g may be affected by the elastic force of the shutter spring **109**, and the elastic force of the elastic member **430** has to be increased in order to offset an influence of the elastic force of the shutter spring **109**. However, according to an embodiment, the discharging shutter **108** is moved to a position where the toner outlet **107** is opened via interference with the interference portion **411** of the lateral bracket **410**. The lateral bracket **410** is fixed to the photoconductive unit **200**, and thus, even when the discharging shutter **108** interferes with the interference portion **411**, an interference force affects only the photoconductive unit **200** and does not affect the development unit **300**. Accordingly, according to the structure in which the discharging shutter **108** is opened or closed by interference between the discharging shutter **108** with the lateral bracket **410**, the development nip N or the development gap g may be stably maintained.

It should be understood that the exemplary embodiments described therein should be considered in a descriptive sense only and not for purposes of limitation. The descriptions of features or aspects within each embodiment should be considered as being available for other similar features or aspects in other embodiments.

While one or more embodiments have been described with reference to the appended figures, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present disclosure as defined by the following claims.

What is claimed is:

1. An imaging cartridge detachable from a main body, the imaging cartridge comprising:

a photoconductive unit comprising a photoconductor on which an elastic latent image is formed;

a development unit comprising a development roller that supplies toner to the photoconductor to develop the toner and a gap maintaining member that constrains an approach distance between the development roller and the photoconductor;

a first position determining portion provided in the development unit;

a lateral bracket that is fixed to a side portion of the photoconductive unit and comprises a second position determining portion that guides the first position determining portion so as to movably support the development unit;

an elastic member that applies to the development unit an elastic force in a direction in which the development roller approaches the photoconductor; and

a driving coupler that is provided at a side of the development unit and transfers a driving force of the main body to the development roller,

wherein a rotational direction of the driving coupler is opposite to a rotational direction of the development roller,

wherein the first position determining portion comprises a first position determining boss and a second position determining boss,

wherein the second position determining portion comprises a first position determining slot and a second position determining slot that have a length such that the development unit is moved in the direction in which the development roller approaches the photoconductor or is separated from the photoconductor,

wherein the first and second position determining bosses are disposed on the same side as the development roller with respect to an area where the development roller and the photoconductor face each other, and

wherein the driving coupler is disposed between the first and second position determining bosses.

2. The imaging cartridge of claim **1**, wherein the first and second position determining slots have a width such that the development unit is rotatable, and

wherein rotation of the development unit is constrained as the first and second position determining bosses contact sidewalls of the first and second position determining slots in a width direction.

3. The imaging cartridge of claim **1**, wherein a direction of a rotational moment applied to the development unit by the driving coupler is the same as a direction of a rotational moment applied to the development unit by the elastic member.

4. The imaging cartridge of claim **1**, wherein the second position determining portion comprises a rotation constraining unit that constrains rotation of the development unit.

5. The imaging cartridge of claim **1**,

wherein the first position determining boss is located at a rotational center of the development roller.

6. The imaging cartridge of claim **5**, wherein the development roller forms a development nip by contacting the photoconductor.

7. An image forming apparatus comprising:

a main body; and

the imaging cartridge of claim **1**.

8. The image forming apparatus of claim **7**, further comprising a toner cartridge that is detachable from the main body and supplies toner to the imaging cartridge.

9. The image forming apparatus of claim **8**, wherein the toner cartridge comprises a toner outlet through which the toner is discharged and a discharging shutter that opens or closes the toner outlet,

wherein the discharging shutter is moved to a position where the toner outlet is opened by interacting with the imaging cartridge when the toner cartridge is mounted in the main body.

10. The image forming apparatus of claim **9**, wherein the toner cartridge further comprises a shutter spring that elastically biases the discharging shutter such that the discharging shutter is moved to a position where the toner outlet is closed.

11. The image forming apparatus of claim **8**, wherein the imaging cartridge comprises a toner inlet through which the toner enters and an inlet shutter that opens or closes the toner inlet.

12. The image forming apparatus of claim **11**, wherein the imaging cartridge further comprises a spring that elastically biases the inlet shutter to a position where the toner inlet is closed.

13. The image forming apparatus of claim **12**, wherein the inlet shutter is opened during the mounting of the toner cartridge to the main body.

14. The image forming apparatus of claim **13**, wherein a protrusion is provided on the toner cartridge to open the inlet shutter.

15. The image forming apparatus of claim **7**, wherein the first and second position determining slots have a width such that the development unit is rotatable, and

wherein rotation of the development unit is constrained as the first and second position determining bosses contact sidewalls of the first and second position determining slots in a width direction.

16. The image forming apparatus of claim **7**, wherein a direction of a rotational moment applied to the development unit by the driving coupler is the same as a direction of a rotational moment applied to the development unit by the elastic member.

17. The image forming apparatus of claim **7**, wherein the second position determining unit comprises a rotation constraining unit that constrains rotation of the development unit.

18. The image forming apparatus of claim **7**,

wherein the first position determining boss is located at a rotational center of the development roller.

19. The image forming apparatus of claim **18**, wherein the development roller forms a development nip by contacting the photoconductor.

20. An imaging cartridge detachable from a main body, the image cartridge comprising:

a photoconductive unit comprising a photoconductor on which an elastic latent image is formed;

a development unit comprising a development roller that supplies toner to the photoconductor to develop the toner and a gap maintaining member that constrains an approach distance between the development roller and the photoconductor;

a first position determining portion provided in the development unit;

a lateral bracket that is fixed to a side portion of the photoconductive unit and comprises a second position determining portion that guides the first position determining portion so as to movably support the development unit;

an elastic member that applies to the development unit an elastic force in a direction in which the development roller approaches the photoconductor;

a driving coupler that is provided at a side of the development unit and transfers a driving force of the main body to the development roller, a rotational direction of the driving coupler being opposite to a rotational direction of the development roller; and

a driving side portion where the driving coupler is disposed and a non-driving side portion on the opposite side of the driving side portion,

wherein the elastic member comprises a first elastic member and a second elastic member that are respectively disposed on the driving side portion and the non-driving side portion, and

wherein an elastic force of the first elastic member is smaller than an elastic force of the second elastic member.

21. An image forming apparatus comprising:

a main body; and

an imaging cartridge detachable from the main body, the imaging cartridge comprising:

a photoconductive unit comprising a photoconductor on which an elastic latent image is formed,

a development unit comprising a development roller that supplies toner to the photoconductor to develop the toner and a gap maintaining member that constrains an approach distance between the development roller and the photoconductor,

a first position determining portion provided in the development unit,

a lateral bracket that is fixed to a side portion of the photoconductive unit and comprises a second position determining portion that guides the first position determining portion so as to movably support the development unit,

an elastic member that applies to the development unit an elastic force in a direction in which the development roller approaches the photoconductor, and

a toner cartridge that is detachable from the main body and supplies toner to the imaging cartridge,

wherein the toner cartridge comprises a toner outlet through which the toner is discharged and a discharging shutter that opens or closes the toner outlet,

wherein the discharging shutter is moved to a position where the toner outlet is opened by interacting with the imaging cartridge when the toner cartridge is mounted in the main body,

wherein the lateral bracket includes an interference portion that contacts the discharging shutter to move the discharging shutter to a position where the toner outlet is opened when the toner cartridge is mounted in the main body.

22. An image forming apparatus comprising:

a main body; and

an imaging cartridge detachable from the main body, the imaging cartridge comprising:

a photoconductive unit comprising a photoconductor on which an elastic latent image is formed,

a development unit comprising a development roller that supplies toner to the photoconductor to develop the toner and a gap maintaining member that constrains an approach distance between the development roller and the photoconductor,

a first position determining portion provided in the development unit,

a lateral bracket that is fixed to a side portion of the photoconductive unit and comprises a second position determining portion that guides the first position determining portion so as to movably support the development unit,

an elastic member that applies to the development unit an elastic force in a direction in which the development roller approaches the photoconductor,

a driving coupler that is provided at a side of the development unit and transfers a driving force of the main body to the development roller, a rotational direction of the driving coupler being opposite to a rotational direction of the development roller, and

a driving side portion where the driving coupler is disposed and a non-driving side portion on a side opposite the driving side portion,

wherein the first position determining portion comprises a first position determining boss and a second position determining boss,

wherein the second position determining portion comprises a first position determining slot and a second position determining slot that have a length such that the development unit is moved in the direction in which the development roller approaches the photoconductor or in a direction in which the development roller is separated from the photoconductor,

wherein the first position determining boss is located at a rotational center of the development roller,

wherein the elastic member comprises a first elastic member and a second elastic member that are respectively disposed on the driving side portion and the non-driving side portion, and

wherein an elastic force of the first elastic member is smaller than an elastic force of the second elastic member.

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